



# ME Seminar



## Coalescence Dynamics of Complex Fluid Droplets

Dr. Pallavi Rajaram Katre, Mechanical Engineering, IISc

### ABSTRACT

The distinction between coalescence events in pendant and sessile droplets lies in the formation and evolution of the liquid bridge formed upon contact. In the case of Newtonian droplets, the evolution of the bridge radius, denoted as  $R$ , follows a relationship where  $R \sim t^b$ , with a universal value of the power-law exponent,  $b$ , indicating the predominant governing forces. However, recent studies on various subclasses of rheologically complex fluids containing macromolecules have emphasized the influence of additional forces on coalescence dynamics. In our research, we investigate this phenomenon experimentally across distinct sub-classes of rheologically complex fluids, such as colloidal and non-colloidal suspensions, where particle hydrodynamic interactions contribute to viscoelasticity. Our findings suggest that these fluids exhibit flow-dependent thinning behaviors with finite elasticity in shear rheology but minimal elasticity in extensional rheology. Building upon these observations, our study extends the Newtonian universality of  $b = 0.5$  to encompass these thinning fluids. Moreover, we support these findings through a theoretical model based on Ostwald-deWaele's constitutive law. In addition to this, we extend our study to highly concentrated polymeric fluid droplets to study the effect of viscosity and elasticity on the droplet curvatures.

### ABOUT THE SPEAKER

Dr Pallavi Rajaram Katre works as an IoE postdoc fellow at Prof. Alope Kumar's lab in the Department of Mechanical Engineering, IISc. She completed her PhD in Chemical Engineering, at IIT Hyderabad, where she explored the evaporation dynamics of binary-sessile droplets laden with different types of nanoparticles experimentally and theoretically. Currently, her interest is in studying complex fluids.



June 13, 2024, 4:00 pm, AR Auditorium, Mechanical Engineering, IISc